ATTACHMENT III

LOUISIANA TECHNOLOGY INNOVATIONS FUND – FINAL REPORT

April 5, 2005

I   **DEPARTMENT/AGENCY**   **LSUHSC-S**

II   **PROJECT TITLE / Log #   Managing Medications and Medical Supplies / #01-002**

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           applicable) http://www.sh.lsuhsc.edu/IT2005/mms2005.html and http://www.sh.lsuhsc.edu/IT2005/

IV   **DESCRIPTION OF THE PROJECT**
        In the time since LSUHSC-Shreveport was awarded the LTIF grant "Saving Livings and Enhancing Efficiency: Managing Medications and Medical Supplies," the healthcare industry and the government have strongly recommended that all hospitals strive to achieve the same goals that we originally proposed. To address these goals, we have worked to reduce medication errors, to improve the efficiency of physicians and hospital personnel, and to improve our billing and collection systems through an integrated plan of information technology improvements and organizational changes. The entire project will take over five years to implement and will result in: (1) an upgrade to our Pharmacy system; (2) a new system to monitor patient medications through the use of wireless technology and barcode scanners; (3) a new system in which physicians place their own orders for medications, laboratory, and radiology tests, consultations, and dietary plans; and (4) a "rules engine" that will advise physicians and nurses regarding appropriate procedures, standard of care, and potential safety infractions.

V   POST IMPLEMENTATION REVIEW AND ASSESSMENT

A.   Executive Summary of Findings
        The project as proposed is complete, and additional system enhancements will continue to be implemented over the next two years. Hospital Administration and nursing staff have become enthusiastic proponents of the Medication Administration Check (MAK) system and the electronic "safety net" that it provides. Statistics regarding the number of adverse drug events that have been prevented by MAK are summarized in this report and represent a dramatic, quantifiable improvement in patient safety. The Computerized Physician Order Entry (CPOE) system is now being used by all staff and residents in Psychiatry. Customization for each of the other medical services will continue over the next two years.
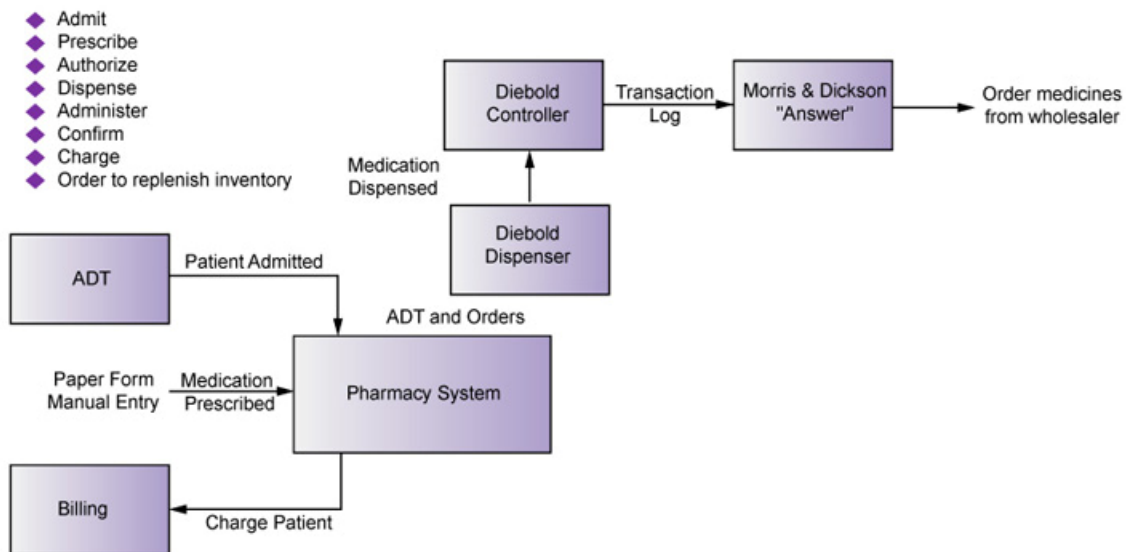
B. Accomplishments and Best Practices Identified

The use of this combination of MAK and CPOE to improve patient safety and enhance efficiency has been attempted by fewer than 10% of the hospitals in the country. Of the twelve Best Practices identified by the "True North" staff of the Advisory Board Company (http://www.advisory.com) in their report Advancing the Patient Safety Agenda: IT strategies for Elevating Healthcare Quality, this project has enabled the implementation of six:
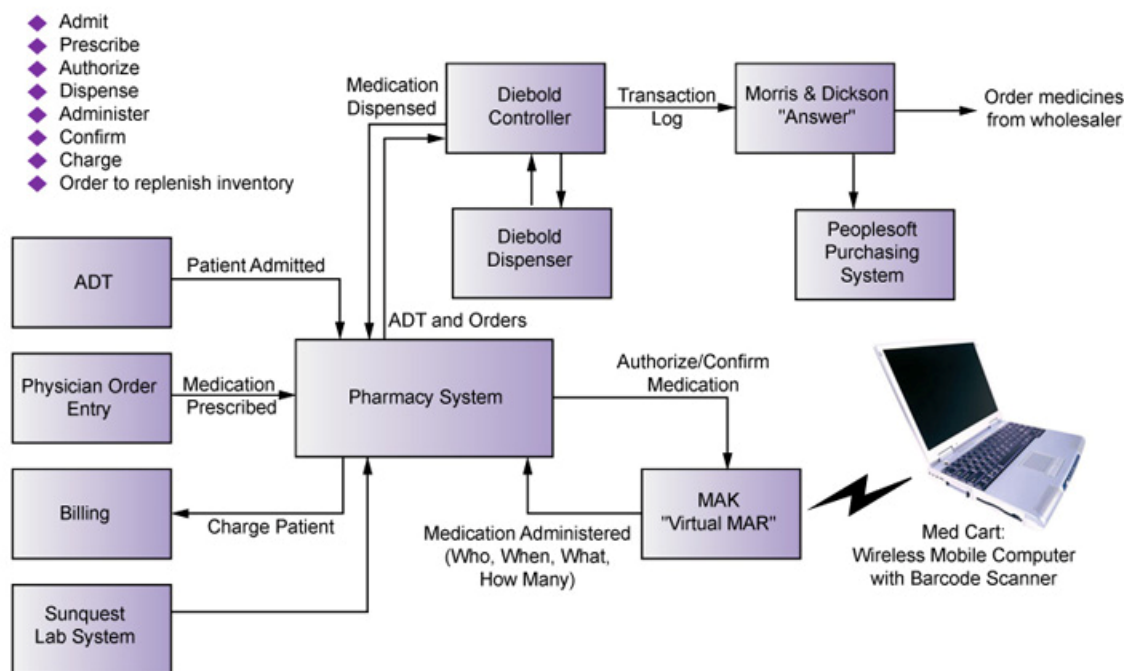
- Pharmacy System Integration
- Barcoded Medication Administration
- Electronic Incident Reporting
- Pharmacy Robot (Out-tasked)
- Corollary Orders/Order Sets
- Physician Order Entry

Other Best Practices identified by the True North report are being implemented in separate, parallel efforts. A graphical view of the project shows the progress made between project inception and the present in developing this safety net.

Medication Management System April, 2001
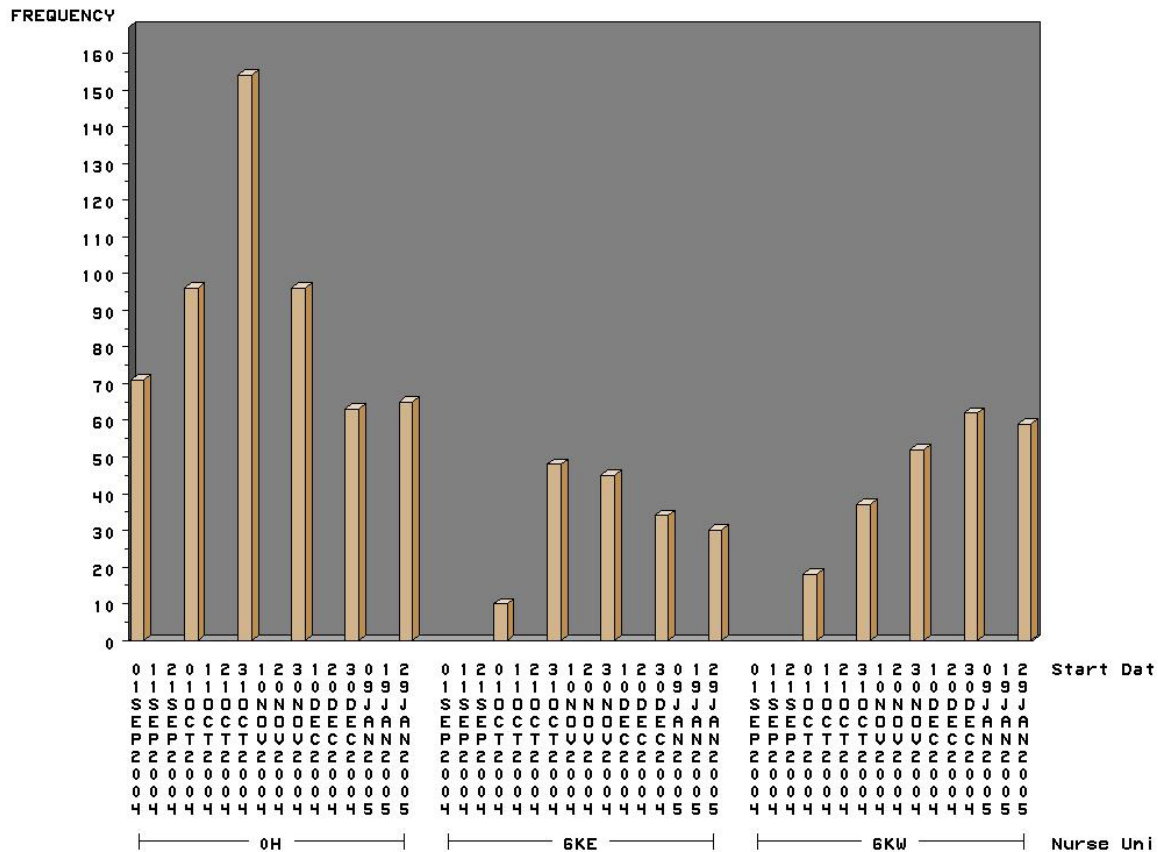
Medication Management System February, 2005

- Admit
- Prescribe
- Authorize
- Dispense
- Administer
- Confirm
- Charge
- Order to replenish inventory

C.   Benefits Achieved/Expected

The outcomes that were originally anticipated are now being accomplished: (1) Patient lives have been protected by avoiding adverse drug reactions resulting from medication errors. (See figures below.) Such reactions can occur because known allergic reactions go unnoticed or because other medications prescribed for the patient interact detrimentally. Length-of-stay in the hospital should also be reduced by avoiding adverse drug reactions, although more time must pass until this change can be measured and compared to baseline data. (2) Medications and supplies can be appropriately charged to the patient, and pilferage can be greatly reduced. Furthermore, a "perpetual inventory system" has been created that greatly eliminates the need for standing inventories and the space to house these inventories. The cost of procuring and distributing medications and supplies has been reduced because the process has been automated. (3) As shown in the figures above, standalone systems have now been interfaced and can exchange information electronically, improving efficiency and reducing errors. (4) The use of barcodes on all medications and supplies has reduced manual data entry and is enabling pharmacy workforce to be re-allocated. Pharmacists can now spend more time assisting and advising physicians.

The figures below show the error rate in three hospital words after the MAK system was implemented. The large number of initial errors is followed by a steady decrease in errors as staff learn to use the system feedback as an additional tool to prevent medication errors from occurring.

Number of Errors: Wrong Patient, Wrong Order, Incorrect Med

FREQUENCY

160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

Start Dat

| 0H | 6KE | 6KW | Nurse Uni |

These three hospital wards were the first in which MAK was installed, so the initial error rate is much greater than was observed in wards that were implemented later. Potential errors have continued to fall since this data gathered from late January, 2005. Note also that these are potential errors that were caught and prevented by the MAK system, so no error in patient medication administration actually occurred.

D.   Pitfalls Encountered

There were a number of barriers to the successful completion of this project.

1. Complexity of the project, especially of CPOE. The fact that less than 5% of the hospitals in the country have implemented CPOE is a commentary on the complexity of the system. Computerized order entry requires a complete change in the way that physicians interact with their environment, so work flow issues in such a complex environment present a formidable implementation problem. Furthermore, an extremely high level of integration among the ancillary systems must already be in place prior to the implementation of CPOE.

2. Personnel required to maintain the systems An additional group of Clinical HelpDesk personnel must be hired to work with physicians around the clock to answer questions and reduce the stress of the enormous change in workflow. This staff does not simply provide temporary services, but rather, must provide permanent, 24x7 coverage for all physicians. The complete implementation for CPOE on this campus will be dependant upon securing sufficient, long-term funding for this staff.

3. Complexity of Human and Social Factors (Software and Hardware User Interface, work flow and process re-engineering) As indicated, work flow redesign is a formidable undertaking, and a

major component involves the user interface. Furthermore, there are both software and hardware interface issues. For example, clinicians generally want different types of computing devices (desktop, laptop, handheld, wireless mobile platform) as an interface. (In our hands, the desktop computer and the wireless mobile "computer on a stick" provided the best interface.)

4. <u>Unexpected and Hidden costs</u> To address the evolving needs of the clinician and the CPOE user interface, vendors release updates and enhancements. Generally, updates are provided at no charge and are included in the cost of system maintenance, while enhancements are considered to be a completely new product. For our vendor (Siemens), CPOE seems be an opportunity to provide a number of completely new, integrated enhancements that are quite expensive. These enhancements are not stand-alone systems but are well integrated into the workflow; however, they are not inexpensive. The cost of the support personnel is also generally underestimated, and there are generally not sufficient staff to address the broad range of user issues.

5. <u>Lack of barcode standards.</u> At the time the project was begun, all medications (especially individual "unit-doses") were not bar-coded by the manufacturer. During project implementation, the FDA ruled that such bar-coding must be done. Although there are still medicines that don't have barcodes, must are now available from the drug supplier and we no longer need to generate our own barcodes for medicines.

E.   Recommendations to Agencies Planning to use this Technology

In 1996, we purchased much of the needed software for this project, so when planning began for this phase of the project, new systems from other vendors were not considered, but rather, we focused on implementing and integrating only the missing components. At his time, however, for the other hospitals of LSUHSC that have not purchased a CPOE system, we recommend serious consideration of VISTA, the system used by the Veterans Administration (VA) Hospitals. VISTA is public domain and there is no cost for the software. VISTA contains all the components needed to implement CPOE and other needed medication safety systems. There will still be a large implementation and hardware cost, but the initial software purchase and long term software maintenance costs can be avoided.

VI   COST VS. BUDGET
(**Note that the costs listed below are not the official costs maintained by the LSHUSC-S Office of Grants Administration, but rather, are the costs as determined by the Project Manager. The final official cost report will be submitted by that office.)

	Category	Budgeted	Actual	Projected Surplus
A.	Equipment	850,000	244,558	343
B.	Software	100,000	-0-	-0-
C.	Telecommunications	-0-	-0-	-0-
D.	Professional/Contract Services	-0-	43,165	-0-
E.	Other Costs	-0-	15,120	-0-
	Total Project Cost	**950,000**	**949, 657**	**343**

VII   ITEMIZED EXPENSES AND FINANCIAL OBLIGATIONS INCURRED DURING ENTIRE REPORTING PERIOD

[*Include description, unit cost, quantity, and total cost for incurred expenses such as equipment, software, and telecommunications. Include contract title, name of contractor, OCR or P.O. Number, and amount for Professional Services and/or other Contract Services.*]

Vendor	P.O. NBR.	Qty	Unit Cost	Total Cost	Description	Type
Pioneer Std Elec	06004280	1	71,251.90	71251.90	Pharmacy System	Equipment
Pioneer Std Elec	06004280	1	1,486.58	1486.58	Pharmacy System	Equipment
Pioneer Std Elec	06004280	1	891.50	891.50	Pharmacy System	Equipment
Pioneer Std Elec	06004280	1	23,540.79	23540.79	DS20e & StorageWorks Warranty	Maintenance
Pioneer Std Elec	06004280	-	3.98	3.98	Freight	Freight
Global	06004603	3	699.00	2097.00	Cisco 802.1 lb Ap w/avail Chas Slot	Equipment
Global	06004603	5	195.00	975.00	Cisco Omni Ceiling Antenna	Equipment
Global	06004603	3	240.00	240.00	Cisco maintenance	Maintenance
Global	06004603	1	2,797.00	2797.00	Cisco Catalyst Enterprise Ed	Software
Global	06004603	1	447.00	447.00	Cisco 24x7 maintenance	Maintenance
Global	06004603	1	4,197.00	4197.00	Cisco Secure Acs 3.0 for Windows	Software
Global	06004603	1	1,020.00	1020.00	Cisco Secure Access Control Server	Maintenance
Global	06004603	-	495.00	495.00	Freight	Freight
Dell Marketing	06006114	11	967.98	10647.78	DellOptiplexGX260	Equipment
Comark Gov't	06006115	2	1,400.13	2800.26	HP LaserJet 4100N Printer	Equipment
NetManage, Inc.	06007546	1	1,250.00	1250.00	Rumba for Terminal Server V6.0	Software
NetManage, Inc.	06007546	-	5.89	5.89	Freight	Freight
Zones	06008118	1	1,890.00	1890.00	Genicom Serial Matrix Printer	Equipment
Zones	06008118	-	75.00	75.00	Freight	Freight
Global Data Sys	06009007	1	9,600.00	9600.00	Internetworking Services	Software
CDW	06009636	3	1,870.00	5610.00	Genicom Serial Matrix Printer	Equipment
Global	06009635	2	608.65	1217.30	Okidata Printer	Equipment
Global	06009635	-	39.64	39.64	Freight	Freight
Pioneer Std.	06009561	4	285.00	1140.00	Lantronix Print Server	Supplies
Pioneer Std.	06009561	-	12.03	12.03	Freight	Freight
Global Data Sys	06009974	1	5,246.41	5246.41	CiscoWireless LAN Soln.	Equipment
Global Data Sys	06009974	1	73,706.00	73706.00	CiscoAironet	Equipment
Global Data Sys	06009974	1	8,786.07	8786.07	Cisco Catalyst3550	Equipment
Oberion	06011257	100	197.44	19744.00	PlenumCeilingEnclosures	Supplies
Oberion	06011257	200	29.95	5990.00	Material for Ceiling Enclosure	Supplies

Dell	06010467	1	5,168.00	5168.00	DellPowerEdge 1650, 36GB	Equipment
Dell	06010467	1	6,570.50	6570.50	DellPowerEdge1650, 146GB	Equipment
Dell	06011004	1	7,540.85	7540.85	DellPowerEdge 2650 Intel Processor	Equipment
Dell	06011391	2	1,529.00	3058.00	Dell Inspiron1100 Intel4 Processor	Equipment
Global	06012339	1	7,407.15	7407.15	Cisco 48port for Catalyst6500	Equipment
Work Order	00119837	1	999.84	999.84	Wireless Installation	Telecomm
Work Order	00119837	1	171.00	171.00	Wireless Installation	Telecomm
Telecommunications	GO9622	1	770.26	770.26	Cabling	Telecommun
SystemID	ProcureCard	1	221.00	221.00	USB Kit	Supplies
GovConnection	06017639	1	1,397.01	1397.01	Pharmacy/ Ck Barcode on Meds	Equipment
NaWare Mobile	06018475	3	4,554.00	13662.00	Medication Admin Mobil Cart	Equipment
National Barcode	06018860	5	1,050.00	5250.00	Wireless Scanners	Equipment
National Barcode	06018860	-	16.00	16.00	Wireless Scanners	Freight
DigiTrax Corp	06019968	4	695.00	2780.00	MAK Armband printers	Equipment
DigiTrax Corp	06019968	-	50.00	50.00	Freight	Freight
Enovate, IT	06021769	87	4,300.00	374100.00	Med Admin Check Carts	Equipment
En Point Technol	06021797	101	248.99	25147.99	Barcode scanner kit	Supplies
En Point Technol	06021797	-	90.00	90.00	Freight	Freight
CDW-G	06022368	18	105.00	1890.00	Cisco802.11A/B/G CardbusAdap	Supplies
Global Data Sys	06022621	69	96.33	6646.77	Cisco802.11A/B/G CardbusAdap	Supplies
Dell	06022910	8	938.00	7504.00	DellDim2400Series	Equipment
Dell	06023835	40	415.75	6236.25	HD Combo Flat Panel/Keyboard Arm	Supplies
Dell	06023835	15	107.10	1606.50	18" extension for HD series arm	Supplies
Dell	06023835	40	873.14	34925.60	DellOptiplexSX280	Equipment
Enovate IT	06023947	25	347.00	8675.00	AM-2310 Desk Mounts	Supplies
Enovate IT	06023833	22	4,300.00	94600.00	MobileAdminCompCarts [22]	Equipment
InsightPublicSector	06023832	1	1,108.26	1108.26	HP Laserjet 4250 Printer	Equipment
InsightPublicSector	06023832	1	1,314.83	1314.83	HP Laserjet 4250tn (two-tray) Printer	Equipment
Circuit Specialists	06023952	1	1,899.00	1899.00	Field Strength Analyzer	Equipment
Circuit Specialists	06023952	-	16.97	16.97	Freight	Freight
Alan Broadband	06023953	1	549.00	549.00	ZapChecker/LogPeriodAntenna	Supplies
Alan Broadband	06023953	-	50.00	50.00	Freight	Freight
Alan Broadband	06023953	-	16.00	16.00	Freight	Freight
Network Orange	06023943	1	4,495.50	4495.50	Air Magnet Mobile Suite	Equipment
Network Orange	06023943	1	8,095.50	8095.50	AirMagnet Enterprise Starter Suite	Equipment
Network Orange	06023943	3	1,912.50	1912.50	AirMagnet Add'l Sensor	Equipment
Sunnytech	06024189	10	22.00	220.00	Zippy WK-712 Keyboards	Supplies
CDW-G	06024155	22	105.00	2310.00	Cisco wireless cards	Supplies
CDW-G	06024155	-	22.09	22.09	Freight	Freight
Dell	06024300	2	837.00	1674.00	DellDimension2400/ER Psych	Equipment
Dell	06024300	-	42.01	42.01	Freight	Freight
Howard Computers	06024877	10	669.00	6690.00	Spare Processors	Equipment
SunnyTech	06024825	10	22.00	220.00	Keyboards	Supplies
EnPointe Technol	06021797A	92	248.99	22907.08	Barcode scanners	Supplies
Global Data Sys	06024980	1	5,351.85	5351.85	Wireless Solution/Cards	Equipment
Global Data Sys	06024980	7	106.47	745.29	CardBus Adapter	Supplies
Global Data Sys	06024980	1	156.87	156.87	Cisco Systems 802.11a/b/g Low Profile	Supplies
Global Data Sys	06024980	1	217.60	217.50	Cisco Smartnet Wireless LAN Solution	Supplies
Global Data Sys	06024980	1	815.20	815.20	Cisco SW App Supp	Supplies
SoftwareHouseInt'l	06024989	1	1,100.81	1100.81	Software: MSDN Universal	Software
Dell	06025007	1	12,991.60	12991.60	Software: Virtual Infrastructure	Software
Viziflex	ProcureCard	150	3.25	493.50	Keyboard covers	Supplies
Viziflex	ProcureCard	-	6.00	6.00	Shipping	Freight
Wal-Mart	ProcureCard	1	165.93	165.93	Mouse pads,Cables,SurgeOutlet	Supplies

Office DepoT	ProcureCard	1	148.01	148.01	Scroll mouse	Supplies
AtaCom	ProcureCard	8	159.60	197.31	Keyboards	Supplies
AtaCom	ProcureCard	-	37.71	37.71	Shipping	Freight